



Newsletter

Volume 13, Number 5
September - October 1996

October is a great time to visit the Institute. The ornamental grasses in the Perennial Garden are fully grown and showing their rich fall colors, and seed pods left on many of the flowers are food for migratory and resident birds, adding a whole new aspect to the garden scene. The Fern Glen, best known for its displays of spring wildflowers, has its share of treasures as well (see page 3).

We ask that you come to the Gifford House Visitor and Education Center for a free permit before you start your visit. Why? First, and foremost, a short chat with the receptionist and a look at the visitor information table brings you up-to-date on what's new and of special interest. Second, the numbered permits are the best way that Education Program staff has of keeping all-important visitation records. And finally, you get the chance to look in and see what's new at the Gift Shop!

It won't take long, so thanks for stopping by on your way to the gardens, trails, internal roadways and greenhouse.

The IES Newsletter is published by the Institute of Ecosystem Studies, located at the Mary Flagler Cary Arboretum in Millbrook, New York.

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Scientists Study Impact of Leaf Damage on Air Quality

It won't be a revelation to many that the blue haze over the Great Smoky Mountains isn't really smoke. It might come as a surprise, however, to learn that the haze is predominantly isoprene, a gas that is emitted naturally by many species of trees. In the atmosphere, isoprene reacts with other chemicals, playing a role in determining the concentrations of ozone, carbon monoxide and methane, so an understanding of what controls isoprene emission in the ecosystem will contribute to an understanding of global climate change. Why, and exactly how plants make isoprene is still somewhat of a mystery.

So, what *is* known about isoprene? A compound made up of carbon and hydrogen, its emission is positively correlated to plant photosynthesis* — for example, production is highest on hot, sunny days when photosynthesis is also at a peak — although exactly why this relationship exists is not clear. Isoprene production varies among tree species, and it is known that oaks are among those that produce large amounts. Also, recent research suggests that in some species defoliation and leaf damage can increase isoprene emission from the leaves remaining on the tree.

Institute of Ecosystem Studies chemical ecologist Dr. Clive Jones has been investigating the chemical responses of plants to leaf damage for a decade. In 1995, he and Dr. Manuel Lerdau, an assistant professor in the Department of Ecology and Evolution at the State University of New York at Stony Brook, did an experiment to test the effects of partial defoliation of red oak (*Quercus rubra*) and eastern cottonwood (*Populus deltoides*) on isoprene emissions. Two weeks after removing many leaves to simulate defoliation, they measured isoprene emissions from the remaining undamaged leaves and found significant changes with defoliation: oak isoprene emissions increased 40%, while those of cottonwood decreased 40%.

* *Photosynthesis is the process by which plants and certain bacteria convert solar energy to the chemical energy of food. Chlorophyll, a green pigment in the cells of these organisms, absorbs sunlight that powers the synthesis of energy-rich carbohydrates (including sugars and starch) from carbon dioxide and water. Oxygen is a principal by-product of this reaction.*

These opposite responses may be related to the way these two tree species utilize carbon reserves in response to leaf damage. At high levels of defoliation, oak trees tend to direct stored root carbohydrate to undamaged leaves, where increased carbon resources may lead to greater isoprene production. Cottonwoods, on the other hand, tend to use the carbon to produce new leaves, leaving little to make isoprene.

Another of Dr. Jones' long-term research interests is the ecological relationships between gypsy moths and their forest environment. Oaks are the gypsy moths' preferred food, so in a gypsy moth outbreak these trees may be partially or completely defoliated. This stripping of the leaves can have a number of consequences, including up to 80% oak mortality if defoliation happens over three successive years. Now it appears that certain levels of damage by these insects may result in increased amounts of isoprene released to the atmosphere as well.

To understand why leaf damage alters the emission of isoprene from plants, it is necessary to know more about biochemical processes in leaves. For two weeks during this past August, Dr. Lerdau did field work at the Institute, using a specially designed

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Cary Summer Fellow Dr. Zophia Gagnon collaborated with Drs. Jones and Lerdau. Her work included chemical analysis of leaves from cottonwood saplings.

Leaf Damage, *continued*

portable analyzer that combines a photosynthesis measuring device with a gas chromatograph. Selecting oak saplings in the oldfield behind the IES greenhouse, he sealed individual leaves in a chamber designed to provide a standard temperature and light level, two factors affecting photosynthesis. The instrument recorded gases as they entered and left the leaf. Some of the oak leaves were cut with scissors to simulate damage by gypsy moths, and isoprene emissions from these leaves were compared with those from undamaged controls.

Cary Fellow Joins Study

Chemical analysis of the test leaves is also a part of the study, to correlate leaf carbon with isoprene emission levels. Collaborating with Drs. Jones and Lerdaun was Cary Summer Fellow Dr. Zofia Gagnon, an assistant professor in the Department of Environmental Sciences at Marist College in Poughkeepsie. Dr. Gagnon's role in the project was to develop a procedure to determine the chemical responses of leaves to damage. Working with red oak and cottonwood leaves, she adapted existing procedures to measure leaf starch, leaf sugars, carbon and nitrogen. Leaves were collected after analysis in the chamber and will be studied in the laboratory over the

coming months, using the specially designed methods.

* * * * *

Dr. Zofia E. Gagnon earned a Ph.D. in plant ecology from the University of Wroclaw (formerly Breslau) in Poland. She came to the United States in 1988 as a postdoctoral fellow at Michigan Technological University where she did research on the effects of ozone and elevated carbon dioxide on trees. At Marist College she teaches courses in ecology, environmental toxicology and general biology.

Dr. Gagnon believes that "to be a good teacher in science it is impossible to be out of research". When she learned about the fellowship opportunity from Dr. Thomas Lynch, her department chair who was himself a Cary Fellow at the Institute in 1985, she applied and was selected.



MOLLY AHEARN

Dennis Gray, a graduate student of Dr. Lerdaun's, checks a printout from the portable gas chromatograph. This instrument is connected to a tripod-held chamber, in which an oak leaf is sealed, that measures photosynthesis and gas exchange. As gases flow through the chromatograph, they are recorded on the printout as individual peaks.

The Cary Summer Fellowship is an award enabling scientists to do research at the Institute, free from the academic responsibilities of their home institutions. The scientists' work contributes to and strengthens their ongoing teaching and research programs. Funds for the award are provided by the Mary Flagler Cary Charitable Trust. Dr. Gagnon is the Institute's 19th Cary Fellow.

Ninety-six second- through seventh-graders were ecologists-for-a-week at the IES Ecology Day Camp during July and August. In eight week-long sessions of alternating age groups, campers explored fields, forests, ponds and streams with educators Jodi Fiorella and Teri Page. They collected, then released, frogs, salamanders, giant water bugs and leeches at Cary Pond, and then compared those creatures with the life in the moving waters of the East Branch of Wappinger Creek. In the Carriage House laboratory, they marveled at butterfly wings and bee mouths magnified by microscopes. They did nature art projects, and played games that sharpened their senses. They followed the Economic Botany Trail in the Greenhouse, where they also did a treasure hunt. And they had the time of their lives!

Below: One morning each week, the campers took nets to a field behind the Gifford House to study insects. Here, Christina Cervone from Poughkeepsie, N.Y. looks at her catch with Ms. Fiorella.



MOLLY AHEARN



JILL CADWALLADER

Flowers and vegetables in the Washington Hollow Neighborhood Center (Millbrook) Community Garden at the IES Perennial Garden are tended by George Figeoia, Doreen Russo and community assistant Ruby Williams. This is the first year that residents of this day treatment center for adults with multiple disabilities have planted and maintained a garden bed at the Institute.

Neighborhood Centers provide training in activities of daily living and social skills; pre-vocational training; physical, occupational and speech therapy; outdoor activities such as chopping and stacking wood and hiking; and community volunteerism. A number of the center's residents do volunteer work for the IES Education Program.

Nurturing Native Plants

October in the Fern Glen ... now is the time to study the subtleties of fall color and fruit, to watch the late pollinators, like a bee wrestling itself into a bottle gentian, and to enjoy the color and texture of winterberries, doll's eyes, poison sumac, cinnamon fern and other native plants.

Ferns, fern allies and wildflowers indigenous to the northeastern United States grow in their natural habitats in the Fern Glen, tended by native plant gardener Judith Sullivan. Renovation of the area over the past several years has made the Fern Glen a native plant showcase, an example of the Institute's commitment to the protection of rare, threatened and endangered species of plants.

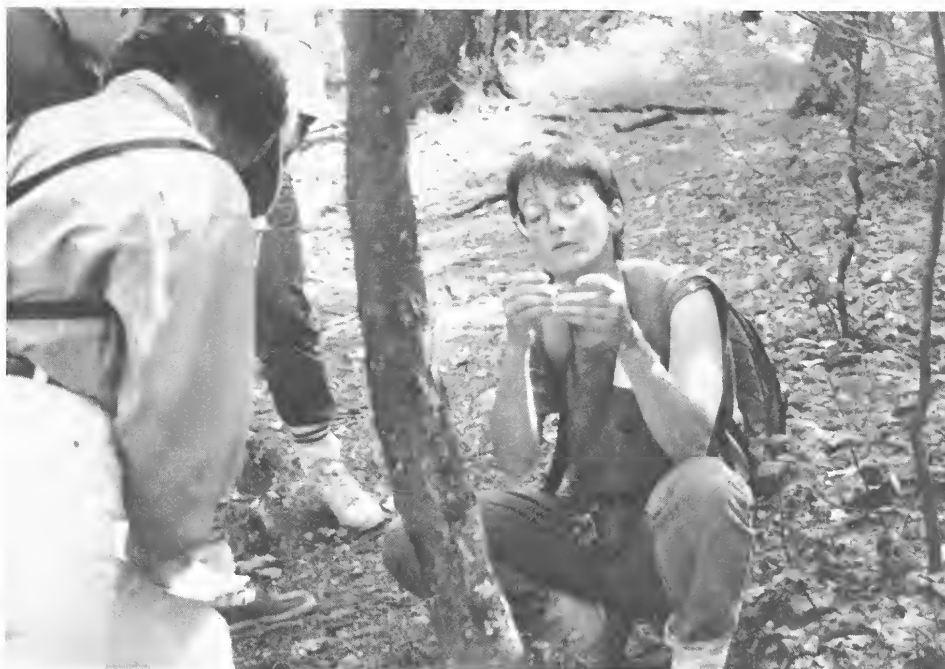
Ms. Sullivan's interest in native plants began as a preference for shade gardens because they were more comfortable to weed in! While tending these gardens, she was entranced by the wildflowers and ferns growing there, and began introducing others to the beauty — not to mention hardiness and resistance to disease and drought — of natives. Her evolution to native plant champion was complete when she became aware of the devastating effects that exotic species such as purple loosestrife and Japanese primrose have on indigenous plant communities.

In June 1992, Ms. Sullivan began to share her respect for and knowledge of native plants with IES Continuing Education Program students when she taught a course about ferns of the Northeast. Since then she has become increasingly involved with this program, most recently as an instructor for "Summer Wild Plant Identification".

NYSNPS

The New York State Native Plant Society (NYSNPS) began when Ms. Sullivan asked Steve Young, state botanist with the Natural Heritage Program (funded by New York state and affiliated with The Nature Conservancy) about the existence of a native plant society in New York. His suggestion to her was the same as his answer to native plant advocate Carol Southby: "Why not start one?" Ms. Sullivan and Ms. Southby, with Andria Post, then a student at the Conway School of Landscape Design, and Janet Marinelli of the Brooklyn Botanic Garden pooled intellectual resources to form NYSNPS.

The goals of the society are, among others, to educate about native plants, to encourage ethical propagation and to serve as a clearing house for information about native plants and ecological land management.



In July, IES Native Plant Gardener Judith Sullivan taught a class about identification of wild plants.

NYSNPS members* will receive a newsletter and a list of nurseries that ethically propagate their plants, and will be able to participate in a seed/spore exchange.

Natives in the Perennial Garden

When the Perennial Garden officially opened in 1985, its purpose was to combine knowledge of ecological principles of plant adaptation and persistence with the best in horticultural design. A few native plant species, such as *Lobelia*, were displayed, but the majority of plants were cultivars and exotics. Some were being tested for hardiness in this zone. Low maintenance was a priority. Now, 11 years later, many of those original plants are thriving, and divisions are made available each spring and fall at the IES plant sales.

Several years ago, perennial gardener Elizabeth Schroeder began introducing more native plants into the perennial garden collection. Celandine poppy in the shade bed was first, then golden Alexanders at the pergola. Now, half the plants in the new xeriscape bed will be natives.

Native plants have built-in tolerances to local conditions. Ms. Schroeder hopes that by bringing them to the formal garden setting she will help visitors discover solutions to their own wet, or dry, or sandy,

or rocky garden problems in ways that involve the creative use of plants rather than the more drastic modification of the landscape. In addition, the new plantings are contributing to the Institute's seed bank, and over the coming years IES plant sales will offer more and more indigenous species to a growing number of native plant gardeners.

Ms. Schroeder, who has been interested in native communities for most of her life, is another who shares her knowledge and enthusiasm with others. In addition to teaching in the Institute's Continuing Education Program, she has spoken recently to Cornell Cooperative Extension groups in Dutchess and Orange counties (N.Y.) on gardening with native plants.

IES Continuing Education Program Emphasizes Ecological Approach

William Montgomery, program leader for Continuing Education, is another IES native plant advocate. Since his arrival at the Institute in 1992, after graduating from the Conway School with a master's degree in landscape design, he has made native plants an important part of the ecological focus of certificate programs, individual courses, workshops and excursions. The listing of upcoming offerings in the newsletter calendar, including "Collecting and Germinating Seeds of Native Plants", "Capturing Native Processes in Design", and "Ecological and Low Maintenance Corporate Landscapes" reflects this emphasis.

** Interested in joining NYSNPS? Send a self-addressed stamped envelope to: Judith Sullivan, Institute of Ecosystem Studies, Box R, Millbrook NY 12545.*

Calendar

CONTINUING EDUCATION

For fall semester catalogues and program information, call the Continuing Education office at 914/677-9643. Fall programs include:

Landscape Design

Oct. 20: Trail Design for Natural Areas

Nov. 16: Capturing Natural Processes in Design
Gardening

Oct. 19: Shrubs for Seasonal Interest

Oct. 26: Collecting & Germinating Seeds of Native Plants

Nov. 2: Progressive Orchid Culture

Nov. 23: Zen Gardens/American Landscape
Natural Science Illustration

Oct. 25, 26, 27: Scientific Illustration

Nov. 4 (6 sessions): Drawing II

Nov. 16, 17: Botanical Illustration/Microscope

Dec. 7, 8: Pen & Ink III

Workshops

Nov. 16: Careers in Horticulture

Nov. 23: Ecological and Low Maintenance

Corporate Landscapes

Natural Crafts

Oct. 19: Pressed Flower Greeting Cards and Note Paper

Oct. 13 (4 ses.): Festive Fall Flower Arrangements

Nov. 2 (6 ses.): Framed Pressed Flower Picture

Nov. 9: Fall Harvest Wreath

Nov. 23: Fresh Pumpkin Arrangement

Dec. 7: Fresh Green Outdoor Holiday Wreath

Dec. 14: Fresh Holiday Arrangement

SUNDAY ECOLOGY PROGRAMS

Free public programs are held on the first and third Sunday of the month, except over holiday weekends. Call 914/677-5359 to confirm the day's topic or, in case of poor weather, to learn the status of the day's program. The following programs begin at 2 p.m. at the Gifford House:

Oct. 20: A Stream Walk, led by Dr. Stuart Findlay
(wear waterproof boots)

Nov. 3: to be announced

Nov. 17: to be announced

Dec. 1: Origami "Tropical Forest Ecosystem", led by Jill Cadwallader

* We strongly recommend that you wear long pants tucked into socks and sturdy waterproof shoes for all outdoor programs.

IES SEMINARS

Free scientific seminars are held Friday at 3:30 p.m. at the IES Auditorium:

Oct. 11: Allelopathy and Interference Competition in Submersed Macrophytes: Insights from the Eurasian Milfoil. Dr. E.M. Gross, Cornell Univ.

Oct. 18: Topic: Tidal Marsh Restoration. Dr. W.A. Niering, Connecticut College

Oct. 25: The Relevance of Structural Equation Modeling to Ecology: Philosophy and Application. Dr. J.B. Grace, Nat'l Wetlands Res. Ctr, Lafayette, La.

Nov. 1: Soil Nitrogen Availability and the Carbon Cost of Maintaining Root Systems in Northern Hardwood Ecosystems. Dr. K.S. Pregitzer, Michigan Technological Univ.

Nov. 8: Watershed Management for the New York City Water Supply. Dr. L. Janus, NYC DEP

Nov. 15: to be announced

Nov. 22: Bacterial Respiration: Implications to Bacterial Growth Efficiency and Net Heterotrophy in Aquatic Sys. Dr. P. DelGiorgio, U. de Montréal

Dec. 6: Ecosystem Processes in a Southern Boreal Forest Under a Natural Disturbance Regime. Dr. D. Paré, Biodome de Montréal

Dec. 13: Diel and Seasonal Patterns in Dissolved Organic N Release. Dr. D.A. Bronk, U. of Georgia.

VOLUNTEER OPPORTUNITIES

The IES Education Program needs volunteers. Current opportunities include assisting with the Volunteer Program itself, as well as in public information, in the Gift and Plant Shop, and in the Education Program administrative office. Volunteers also will have the chance to help with ecology education programs for school groups.

For information on opportunities and benefits, call Ms. Su Marcy at 914/677-5359.

HOURS

Winter hours: October 1 - April 30

Closed on public holidays.

Public attractions are open Mon. - Sat., 9 a.m.-4 p.m. & Sun. 1-4 p.m., with a free permit*.

The IES Gift and Plant Shop is open Mon.- Fri., 11 a.m.-4 p.m., Sat. 9 a.m.-4 p.m. & Sun. 1-4 p.m. (The shop is closed weekdays from 1-1:30 p.m.)

* Free permits are required for visitors and are available at the Gift Shop daily until 3 p.m.

GREENHOUSE

The IES greenhouse, a year-round tropical plant paradise and a site for controlled environmental research, is open until 3:30 p.m. daily except public holidays. Admission is by free permit (see HOURS).

IES GIFT AND PLANT SHOP

New in the Shop ... gardening bucket organizers ... gardening hats ... short- & long-handled "EZ-Diggers" ... kneepads ... for children ... great nature books!

Senior Citizens Days: 10% off on Wednesdays

•• Gift Certificates are available ••

MEMBERSHIP

Join the Institute of Ecosystem Studies. Benefits include a member's rate for courses & excursions, a 10% discount on Gift Shop purchases, a free subscription to the newsletter and participation in a reciprocal admissions program. Individual membership: \$30; family membership: \$40. Call Ms. Janice Claiborne at 914/677-5343.

The Institute's Aldo Leopold Society

In addition to receiving the benefits listed above, members of The Aldo Leopold Society are invited guests at spring and fall IES science updates. Call Ms. Jan Mittan at 914/677-5343.

TO CONTACT IES ...

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